TEST 2

1. Internal energy of a system can be changed through?

- A: Heat
- B: Work
- C: Both A and B
- D: None of the above.

2. ΔH is positive in which of the following reactions?

- A: Endothermic.
- B: Exothermic.
- C: Isothermic.
- D: All of the above.

3. Heat of formation of one mole of liquid water from its ionic components is called?

- A: Enthalpy of hydration.
- B: Enthalpy of formation.
- C: Enthalpy of neutralization.
- D: Enthalpy of solution.

4. Which of the following equation would give the enthalpy of combustion? (assume standard form of the reactants and products)

- A: $CH_4 + 2\ O_2$ ----------> $CO_2 + 2\ H_2O$ $\Delta H = -A$
- B: $C + O_2$ ----------> CO_2 $\Delta H = -B$
- C: $C_2H_5OH + 3O_2$ ----------> $2CO_2 + 3H_2O$ $\Delta H = -C$
- D: All of the above.

5. A reaction from X ---> Y has enthalpy change of 10 KJ. If this reaction is broken down into three step then the total change in enthalpy would change to?

- A: Remain same
- B: 15 KJ
- C: 30 KJ
- D: - 10 KJ

6. Heat of reaction at a constant pressure is called?

- A: Change in internal energy.
- B: Change in kinetic energy.
- C: Change in potential energy.
- D: Change in enthalpy.

7. Melting of ice at room temperature is ?

- A: Spontaneous exothermic process.
- B: Spontaneous endothermic process.
- C: Non-spontaneous exothermic process.
- D: Non-spontaneous endothermic process.

8. Change in enthalpy ΔH = ?

- A: q_v
- B: q_p
- C: $q_v - q_p$
- D: $q_v + q_p$

9. ΔH will be given a negative sign in?

- A: Decomposition reactions
- B: Exothermic reactions
- C: Dissociation reactions
- D: Endothermic reactions

10. Which of the following is a state function?

i. Enthalpy, ii. Heat, iii. Work

- A: i only
- B: i and ii only
- C: ii and iii only
- D: i and iii only

11. Which one of the following is not included in internal energy?

- A: Vibrational energy
- B: Energy arising out of collision forces
- C: Electronic energy
- D: Energy arising out of gravitational pull

12. **During the manufacturing of nitric acid, nitric oxide is oxidized to nitrogen oxide. This reaction is given as :**

$2NO + O_2 \xrightarrow{\quad\quad} 2NO_2 \qquad \Delta H = -114kJ/mol$

According to Le Chatellier's principle :

- A: Reaction must be carried out at room temperature
- B: Reaction must be carried out at low temperature
- C: Reaction must be carried out at high temperature
- D: Reaction must not be temperature dependant

13. Which of the following is an exothermic reaction?

- A: $2H_2O$ ----------> $H_2 + O_2$ $\Delta H = +285$ kJ/mol
- B: $N_2 + O_2$ ----------> $2NO$ $\Delta H = +180$ kJ/mol
- C: $N_2 + H_2$ ----------> $2NH_3$ $\Delta H = -41$ kJ/mol
- D: All of the above.

14. The equation that represents the standard enthalpy of atomization of hydrogen is :

- A: 1/2 H_2O (L) ---------> H_2 (g)+ 1/2O_2 (g) $+218kJmol^{-1}$
- B: 1/2 H_2 (g) ---------> H (g) $+218kJmol^{-1}$
- C: 1/2 H_2O (L) ---------> H_2 (g) + 1/2O_2 (g) $-218kJmol^{-1}$
- D: 1/2 H_2 (g) ---------> H (g) $-218kJmol^{-1}$

15. Which of the following state function is impossible to measure in a given state?

- A: Pressure
- B: Volume
- C: Enthalpy
- D: All of them can be measured in a given state.

16. Which of the following is a limiting case between the spontaneous and non-spontaneous process?

- A: Endothermic process.
- B: Exothermic process.
- C: Irreversible process.
- D: Reversible process.

17. Which of the following is true for the exothermic reactions?

- A: Enthalpy of the products is more than that of the reactants.
- B: Enthalpy of the products is less than that of the reactants.
- C: Enthalpy of the products is equal to that of the reactants.
- D: Enthaply of reactants or products has no relation with the reaction being exothermic or endothermic.

18. **Comustion of graphite to form CO_2. can be done by two ways. Reactions are given as follows**

$C + O_2$ ----------> CO_2 $\Delta H =$ -393.7 KJ/mol

C + O ----------> CO $\Delta H_1 = ?$

C + 1/2O_2 ----------> CO_2 $\Delta H_2 =$ -283 KJ/mol

What will be enthalpy of formation of CO?

- A: -676 KJ/mol
- B: 110 KJ/mol
- C: -110 KJ/mol
- D: 676 KJ/mol

19. Sublimation, vaporization, melting and photosynthesis all are examples of ?

- A: Spontaneous processes
- B: Physical processes
- C: Exothermic processes
- D: Endothermic processes

20. Enthalpy of neutralization for any strong acid with a strong base is equal to?

- A: -57.4 KJ/Mol
- B: 57.4 KJ/Mol
- C: -574 KJ/Mol
- D: 574 KJ/Mol

TEST 3

1. If ΔE of a system = q. What can you conclude about the system?

- A: The system is isothermic.
- B: The system is adiabatic.
- C: The system has constant volume.
- D: The system is a gas system.

2. The enthalpies of combustion of carbon and carbon monoxide are - 393.5 and - 283 kJ mol^{-1} respectively. The enthalpy of formation of carbon monoxide per mole is?

- A: -110.5 KJ
- B: +110.5 KJ
- C: -676.5 KJ
- D: + 676.5 KJ

3. 2 moles of helium gas are expanded isothermally and irreversibly at 270C from volume 1 dm^3 to 1 m^3 at a constant pressure of 100 kPa. Calculate the work done?

- A: 99900 KJ
- B: 99900 J
- C: 34464 KJ
- D: 34464 J

4. Heat of formation, ΔH^o_f of an explosive compound like NCl_3 is?

- A: Positive
- B: Negative
- C: Zero
- D: Cannot answer from the given information.

5. If $C_6H_6(I) + 15/2\ O_2\ (g) \text{---> } 3H_2O(I) + 6CO_2\ (g)$; $\Delta H = -3264.6 kJ\ mol^{-1}$, then the energy obtained by burning 4 g of benzene in air is ?

- A: 115 KJ
- B: 167 KJ
- C: 183 KJ
- D: 198 KJ

6. If ΔE of a system = q. Work done by the system is?

- A: Zero
- B: Positive
- C: Negative
- D: Undefined

7. **Consider the following hypothetical reaction:**

$A_2(g) + 3B_2(g) \text{---> } 2AB_3(g)$

If the enthalpy change for the reaction is – 90 kJ, what will be the enthalpy of formation of $AB_3(g)$?

- A: – 90 Kj
- B: – 180 kJ
- C: – 45 kJ
- D: – 30 kJ

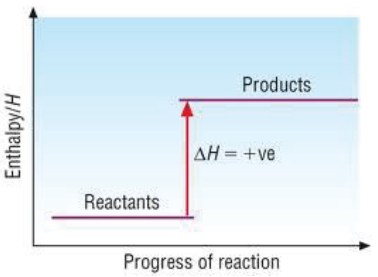
8. **A balloon is heated by supplying 600J of heat. The balloon expands doing 200J of work against the atmospheric pressure. The change in internal energy of ?**

- A: - 800 J
- B: - 400 J
- C: 0 J
- D: + 400 J

9. **Which of the following reaction would give the enthalpy of atomization?**

- A: $H_2 + 1/2O_2$ ---------> H_2O $\Delta H = -A$
- B: O + O ---------> O_2 $\Delta H = -B$
- C: $1/2H_2$ ----------> H $\Delta H = -C$
- D: $H^+ + OH^-$ ----------> H_2O $\Delta H = -D$

10. **The figure below shows what kind of reaction?**



- A: Isothermic
- B: Exothermic
- C: Endothermic
- D: Any of the above.

11. **In a glass calorimeter, mass of the reactants is 100 g, specific heat of the solution is 4 JK-1g-1. Mixing of 0.1 mole of an acid and base in the solution increases the temperature from STP temperature to 30° C. What is the heat evolved in this reaction?**

- A: -2 KJ
- B: - 20 KJ
- C: - 10 KJ
- D: - 100 KJ

12. **In order to check the spontaneity of a reaction which of the following is studied?**

- A: Heat exchange.
- B: Enthalpy.
- C: Reaction kinetics.
- D: Free energy.

13. **In a glass calorimeter, mass of the reactants is 100 g, specific heat of the solution is 4 $JK^{-1}g^{-1}$. Mixing of 0.1 mole of an acid and base in the solution increases the temperature from STP temperature to 30° C. What is the enthalpy of neutralization?**

- A: - 2 KJ
- B: - 10 KJ
- C: - 20 KJ
- D: - 100 KJ

$2H_2 + O_2 \rightarrow 2H_2O$

14. If H_f is the heat of formation of H_2O and H_r is the heat of this reaction, then ?

- A: $H_f = H_r$
- B: $H_f = H_r / 2$
- C: $H_r = H_f / 2$
- D: None of the above.

15. Which of the following is a spontaneous process?

- A: $N_2 + O_2$ ----------> NO
- B: $H_2 + O_2$ ----------> H_2O
- C: NaOH + HCl ----------> NaCl + H_2O
- D: All of the above.

16. Which of the following statement is correct?

- A: Total energy of the products in endothermic reaction is equal to that of the reactants.
- B: Total energy of the products in exothermic reaction is equal to that of the reactants.
- C: Total energy of the products is always equal to that of the reactants.
- D: Total energy of the products is never equal to that of the reactants.

17. Which of the following is an example of spontaneous process?
i. Burning of coal, ii. Neutralization of acid-base, iii. Evaporation

- A: ii only.
- B: iii only
- C: ii and iii only
- D: i, ii and iii only.

18. Consider the reaction: $2C + O_2$ ---> $2CO_2$. ΔH = - 395.5 kJ/mol. Which of the following statements is/are correct for this reaction?

- A: The reaction gives the heat of formation.
- B: The reaction in exothermic.
- C: Reaction needs no initiation.
- D: All of the above.

19. Which of the following pairs has the highest enthalpy of neutralisation?

- A: NH_4OH and CH_3COOH
- B: NH_4OH and HCl
- C: KOH and CH_3COOH
- D: KOH and HCl

20. Which of the following reaction would give the enthalpy of reaction?

- A: $H_2(g) + 2O_2(l)$ ---------> $2H_2O(l)$ at 298 K and 1 atm
- B: $H_2(g) + 2O_2(g)$ ---------> $2H_2O(l)$ at 298 K and 1 atm
- C: $H_2(g) + 2O_2(g)$ ---------> $2H_2O(g)$ at 298 K and 1 atm
- D: All of the above.

TEST 4

1. **Heat capacity of the bomb calorimeter is 80 kJ/K, if change in temperature is 5K then what is the heat evolved?**

- A: 16 kJ
- B: 32 kJ
- C: 124 kJ
- D: 400 kJ

2. **In which of the following conversions, value of ΔS will be negative?**

- A: H_2O (l) ---> H_2O (g)
- B: H_2O (S) ---> H_2O (l)
- C: H_2O (g) ---> H_2O (S)
- D: H_2O (S) ---> H_2O (g)

3. **Enthalpy of combustion is?**

- A: Always positive
- B: Always negative
- C: May be positive or negative.
- D: Same for all reactions.

4. **Which of the following equations correctly represents the standard enthalpy of formation ΔH^o_f of methane?**

- A: C (diamond) + 4H(g) --> CH_4(g)
- B: C (diamond) + $2H_2$(g) --> CH_4(g)
- C: C (graphite) + $2H_2$(g) --> CH_4(g)
- D: C (graphite) + 4H(g) --> CH_4(g)

5. **The enthalpy of formation of H_2O (l) is - 285.77 kJ mol^{-1}. Enthalpy of neutralization of a strong acid and strong base is - 56.07 kJ mol^{-1}. What is the enthalpy of formation of OH^- ion?**

- A: -229.7 KJ
- B: +229.7 KJ
- C: +350.7 KJ
- D: -350.7 KJ

6. **A hypothetical reaction A --->2B, proceeds through following sequence of steps**

A ---> C ΔH = q, *C ---> D ΔH = r,* *½ D ---> B ΔH = s*

Then the heat of reaction A --->2B is?

- A: q - r – s
- B: q - r + 2s
- C: q + r + s
- D: q + r + 2s

7. Which of the following is not a state function?

- A: Volume
- B: Temperature
- C: Work
- D: Enthalpy

8. Which of the following has the highest magnitude?

- A: Heat of vaporization.
- B: Heat of condensation.
- C: Heat of sublimation.
- D: All have same value.

9. Which of the following is true about the spontaneous processes?

- A: They are always endothermic.
- B: They are always exothermic.
- C: They may be exothermic or endothermic.
- D: They are always isothermic.

10. Which of the following accurately defines the enthalpy of solution?

- A: The amount of heat evolved when one mole of a substance is dissolved in so much solvent that further dilution results in no detectable heat change.
- B: The amount of heat absorbed when one mole of a substance is dissolved in so much solvent that further dilution results in no detectable heat change.
- C: The amount of heat absorbed or evolved when one mole of a substance is dissolved in so much solvent that further dilution results in no detectable heat change.
- D: The amount of heat absorbed or evolved when one mole of a substance is dissolved in so much water that further dilution results in no detectable heat change.

11. Lattice energy of an ionic crystal is the ethalpy of:

- A: Combustion
- B: Dissociation
- C: Formation
- D: Dissolution

12. Enthalpy change that occurs when number of moles of reactants as indicaed by the balanced chemical equation react at STP is called?

- A: Enthalpy of formation.
- B: Enthalpy of atomization.
- C: Standard enthalpy of reaction.
- D: Enthalpy of neutralization.

13. Reactants have high energy than products in:

- A: Endothermic reactions
- B: Exothermic reactions
- C: Photochemical reactions
- D: Non-sapontaneous reactions

14. Heat evolved or absorbed in a glass calorimeter is given by the mathematical equation?

- A: $q = m/s\Delta T$
- B: $q = s\Delta T$
- C: $q = c\Delta T$
- D: $q = ms\Delta T$

15. The scope of thermo chemistry is limited because?

- A: Only a few reactions have heat exchange.
- B: Study of heat exchange is not important.
- C: In most of the reactions, heat produced in the system is negligible as compared to the surroundings.
- D: Heat reaction can be accurately measured only for a few reactions.

16. In standard ethalpy of atomization heat of surrounding:

- A: Remains same1
- B: Increases
- C: Decreases
- D: Increases then decreases

17. All of the following processes are spontaneous except ?

- A: $H_2O_{(l)}$ ----> $H_2O_{(g)}$
- B: Combustion of natural gas.
- C: Neutralization of HCI by NaOH.
- D: Synthesis of glucose by plants.

18. Standard enthalpy of solution of ammonium chloride in kJ/mol is?

- A: +25
- B: +16.2
- C: +14.78
- D: +26.0

19. An ideal solution has an enthalpy of solution equal to?

- A: A positive value.
- B: A negative value.
- C: May be positive or negative.
- D: Zero.

20. As per Hess's law $\Sigma\Delta H$ (reaction) = ?

- A: Zero
- B: $\Sigma\Delta H$ (products) - $\Sigma\Delta H$ (reactants)
- C: $\Sigma\Delta H$ (products) + $\Sigma\Delta H$ (reactants)
- D: $\Sigma\Delta H$ (reactants) - $\Sigma\Delta H$ (products)

Chemical Equilibrium

TEST 1

1. K_c has no units if?

- A: K_c never has units.
- B: Reactants moles at equilibrium are higher than products moles.
- C: Products moles at equilibrium are higher than reactants moles.
- D: Reactants moles at equilibrium are equal to the products moles.

2. Lowering temperature favors the yield of ammonia in Haber process. However, the temperature is not lowered below 400°C because?

- A: It is expensive to maintain lower temperature.
- B: Rate of formation of ammonia is low at lower temperatures.
- C: Yield starts decreasing beyond this threshold temperature.
- D: Lowering temperature would lower pressure that decreases yield

3. The "pH" of our blood is:

- A: 6.7-8
- B: 7.5
- C: 7.9
- D: 7.35 - 7.4

4. A system at equilibrium can be disturbed by:

- A: Concentration change
- B: Pressure change
- C: Temperature
- D: All of the above

5. Which of the following is true as per the law of mass action?

- A: Rate at which reaction proceeds is directly proportional to the product of masses of the reactants.
- B: Rate at which reaction proceeds is directly proportional to the product of active masses of the reactants.
- C: Rate at which reaction proceeds is directly proportional to the sum of active masses of the reactants.
- D: Rate at which reaction proceeds is independent of the active masses of the reactants.

6. Conjugate base of a weak acid is?

- A: Weak base
- B: Very weak base
- C: Strong base
- D: Weak acids do not have a conjugate base

7. The chemical substance, when dissolved in water, gives "H" is called:

- A: Neutral.
- B: Base.
- C: Acid.
- D: Amphoteric.

8. Active mass of solutions is represented in terms of?

- A: grams
- B: moles
- C: moles / dm^3
- D: None of the above.

9. The study of equilibrium constant provides us which of the following information?

- A: Direction of reaction
- B: Extent of reaction
- C: Effect of various factors on equilibrium position
- D: All of the above.

10. Relation between K_P and K_c is?

- A: $K_p = K_c / (RT)^{2n}$
- B: $K_p = K_c(RT)^n$
- C: $K_p = K_c / (RT)^{\Delta n}$
- D: $K_p = K_c(RT)^{\Delta n}$

11. K_w = ?

- A: K_a x K_b
- B: K_a / K_b
- C: K_b / K_a
- D: $K_a + K_b$

12. When reactant and product moles at equilibrium are not equal, K_c has units related to?

- A: Concentration
- B: Volume
- C: Pressure
- D: Concentration or Pressure.

13. When 10^{-4} mole of a mono basic strong acid is dissolved in 1 liter of the solvent, its pH is?

- A: $\log 10^{-4}$
- B: $1 / \log 10^{-4}$
- C: $-\log 10^{-4}$
- D: $-1 / \log 10^{-4}$

14. Buffer capacity of a solution is defined as?

- A: It capacity to remain neutral.
- B: Its capability to resist a change in pH
- C: Extra cautions in a buffer
- D: Extra anions in a buffer

15. Suppression of ionization of a weak electrolyte by adding a common ion from outside is called?

- A: Common electrolyte effect.
- B: Ionization effect.
- C: Common ion effect.
- D: Le-Chatelier's principle

16. pH for acidic solutions is?

- A: Less than 7
- B: Greater than 7
- C: Equal to 7
- D: Zero.

17. 2.45g of PbF_2 is dissolved in one liter of water. What are the number of moles if molecular mass of PbF_2 = 245.

- A: 0.01 mole
- B: 0.1 moles
- C: 1 mole
- D: 10 mole

18. K_a = ?

- A: $[H_3O^+]\,[A^-] / [HA]\,[H_2O]$
- B: $[H_3O^+] / [HA]\,[H_2O]$
- C: $[H_3O^+]\,[A^-] / [H_2O]$
- D: $[H_3O^+]\,[A^-] / [HA]$

19. Which of the following statement is true as per Le-Chatelier's Principle?

- A: If a stress is applied to a system before it reaches equilibrium the system acts to nullify the effect of stress.
- B: If a stress is applied to a system before it reaches equilibrium the system acts to support the effect of stress.
- C: If a stress is applied to a system at equilibrium the system acts to support the effect of stress.
- D: If a stress is applied to a system at equilibrium the system acts to nullify the effect of stress.

20. If the value of K_c is small this means that?

- A: Reaction has equal amount of products and reactants at equilibrium
- B: Equilibrium is favored towards the forward direction.
- C: Equilibrium is less favored towards the forward direction.
- D: The reversible reaction would never reach an equilibrium

TEST 2

1. **A breaker contains a solution of $KClO_3$. When potassium chloride (KCI) is added to this solution, some of $KClO_3$ is precipitated. We may infer that?**

- A: $KClO_3$ is more soluble in water than KCI
- B: KCI is more soluble in water than $KClO_3$
- C: Both $KClO_3$ and KCI are soluble water to some extent
- D: Both $KClO_3$ and KCI have same level of solubility in water

2. **If at any temperature, K_c is the equilibrium constant of the reaction, N_2 (g) + $3H_2$ (g) ⇌ 2 NH_3 (g), what will be the affect of increasing pressure from 5 atm.to 50 atm.?**

- A: Decrease the yield of ammonia as well as value of Kc.
- B: Increase the yield of NH_3 but will not change the value of Kc.
- C: Increase the yield of NH_3 as well as the value of Kc.
- D: Decrease the yield of ammonia as well as the value of Kc.

3. **Which of the following reversible reactions will not be affected by the change in pressure?**

- A: $2SO_2 + O_2$ ---> $2SO_3$
- B: $N_2 + O_2$ ---> 2NO
- C: $N_2 + 3H_2$ ---> $2NH_3$
- D: All of them would be affected by the change in pressure.

4. **Which of the following statement is true?**

- A: Strong bases would have large values for K_b and pK_b.
- B: Strong bases would have small values for K_b and pK_b.
- C: Strong bases would have small value for K_b and large value for pK_b.
- D: Strong bases would have large value for K_b and small value for pK_b.

5. **The value of K_c is affected by?**

- A: Temperature
- B: Pressure
- C: Concentration
- D: None of the above.

6. The value of equilibrium constant Kc for a given reaction $2HF \rightleftharpoons H_2 + F_2$ is 10^{-3} at 2000 °C . What will be value of Kp?

- A: 2×10^{-13}
- B: 10^{-13}
- C: 186×10^{-13}
- D: 3.48×10^{-9}

7. Which of the following is true regarding the effect of catalyst on equilibrium?

- A: Catalyst tend to increase the rate of reaction in the forward reaction.
- B: Catalyst tends to increase the rate of reaction in the reverse direction.
- C: Catalyst has no effect on the rate of reaction.
- D: Catalyst increases the rate of reaction in both forward and reverse direction and has no effect on the equilibrium.

8. Hydroxyl ion concentration of 10^{-2} M HCl is?

- A: 10^{-2}
- B: 10^{-6}
- C: 10^{-12}
- D: 10^{-14}

9. Acidic buffers are created by?

- A: Mixing a weak acid and a salt of it with a weak base.
- B: Mixing a weak acid and a salt of it with a strong base.
- C: Mixing a weak base and a salt of it with a strong acid.
- D: Mixing a weak base and a salt of it with a weak acid.

10. Which catalyst is used in the Haber's process?

- A: Sodium mixed with Al_2O_3
- B: Copper mixed with MgO
- C: Iron mixed with MgO
- D: Potassium mixed with Al_2O_3

11. Which of the following statement is true about water?

- A: K_w of water is 14.
- B: It is a weak electrolyte.
- C: It is a strong electrolyte.
- D: Addition of acid changes the ionic product of water.

12. If heat of solution of a salt is close to zero then increasing temperature?

- A: Increases its solubility
- B: Decreases its solubility
- C: Has no effect on its solubility
- D: Could be any of the above.

13. In haber process for manufacturing of ammonia ,nitrogen is taken from:

- A: Proteins occuring in bodies
- B: Ammonium salts obtained industrially
- C: Air
- D: Minerals containing nitrates

14. pOH of basic buffer is given by?

- A: $pOH = pK_b + \log [salt] / [base]$
- B: $pOH = pK_b + \log [base] / [salt]$
- C: $pOH = pK_b - \log [salt] / [base]$
- D: $pOH = pK_b - \log [base] / [salt]$

15. In the reaction PCl_5 (g) ⇌ PCl_3 (g) + Cl_2 (g), the equilibrium concentrations of PCl_5 and PCl_3 are 0.4 and 0.2 mole/litre respectively. If the value of K_C is 0.5, what is the concentration of Cl_2 in mole/litre?

- A: 0.5
- B: 1.0
- C: 1.5
- D: 2.0

16. Value of K_c for the given equation is?

$aA + bB \rightleftharpoons cC + dD$

- A: $[A]^a[B]^b / [C]^c[D]^d$
- B: $[C]^c[D]^d / [A]^a[B]^b$
- C: $[A]^a[B]^b * [C]^c[D]^d$
- D: [C] [D] / [A] [B]

17. If in AgCl solution,some NaCl salt is added ,AgCl will precipitated out due to:

- A: Solubility
- B: Electrolyte
- C: Unsaturation effect
- D: Common ion effect

18. At a given temperature the equilibrium constant for the reaction of carbon monoxide and oxygen to produce carbon dioxide is very large ($K_c = 5 \times 10^{35}$). When the reaction is at equilibrium which of the following would be true?

- A: Concentration of carbon dioxide will be much larger than both reactants.
- B: Concentration of carbon dioxide will be much smaller than concentrations of both reactants.
- C: Concentration of carbon monoxide will be much larger than the concentration of carbon dioxide
- D: Concentration of oxygen will be much larger than concentration of carbon monoxide

19. If $K_a > 1$ then the acid is?

- A: Very weak
- B: Weak
- C: Moderate
- D: Strong

20. Solubility of $Ce(SO_4)_3$:

- A: Increase with the increase in temperature
- B: Decrease with the increase in temperature
- C: Remains constant with increasing temperature
- D: None of the above

TEST 3

1. **In the equilibrium $PCl_5 \rightleftharpoons PCl_3 + Cl_2$; $\Delta H = 22$ kcal, the disintegration of PCl_5 will be more on?**

- A: Increasing pressure
- B: Increasing concentration of cholorine
- C: Increasing temperature
- D: Decreasing temperature

2. **At constant temperature, diluting an acid would have what effect on its K_a?**

- A: K_a would increase.
- B: K_a would decrease.
- C: K_a would remain same.
- D: K_a would decrease sharply.

3. **If V is the volume, a is number of moles of N_2O_4 and x is the number of moles of N_2O_4 decomposed. The K_c for the given equation is?**

$N_2O_4 \rightleftharpoons 2NO_2$

- A: $4x^2V / (a-x)$
- B: $4x^2 / (a-x)V$
- C: $2x^2 / (a-x)V$
- D: $2xV / (a-x)$

4. **Optimum conditions for Haber's process are?**

- A: P = 200-300 atm and T = 673 K
- B: P = 100-200 atm and T = 673 K
- C: P = 200-300 atm and T = 473 K
- D: P = 100-200 atm and T = 473 K

5. **What will be the pH of a solution NaOH of concentration of 10^{-3}M?**

- A: 3
- B: 7
- C: 11
- D: 14

6. **What is the pH of a buffer solution in which 10 M of CH_3COONa and 1 M of CH_3COOH are present. pKa for $CH_3COOH = 4.74$.**

- A: 3.82
- B: 4.74
- C: 4.89
- D: 5.74

7. Which of the following statement is true about K_w?

- A: Value of K_w increases linearly with increasing temperature.
- B: Value of K_w decreases linearly with increasing temperature.
- C: Value of K_w increases non-linearly with increasing temperature.
- D: Value of K_w decreases non-linearly with increasing temperature.

8. A --> B + C,

If Kp = 1.2 at 1000 K what is the value of K_c for the given reaction?

- A: 0.010
- B: 0.015
- C: 0.025
- D: 0.038

9. The solubility of $Mg(OH)_2$ is S moles/ litre. The solubility product under the same condition is?

- A: $2S^3$
- B: $4S^3$
- C: $2S^2$
- D: $4S^2$

10. 0.005 M acid solution has pH of 5. The percentage ionization of acid is?

- A: 0.2 %
- B: 0.4 %
- C: 0.6 %
- D: 0.8 %

11. The solubility of CaF_2 in pure water is 2.0×10^{-6} mol dm^{-3}. Its solubility product will be?

- A: 2×10^{-12}
- B: 4×10^{-12}
- C: 12×10^{-18}
- D: 32×10^{-18}

12. A 0.1 mol/dm^3 aqueous solution of a weak acid is 2% ionized. If the ionic product of water is 1×10^{-14} the $[OH^-]$ is?

- A: 2×10^{-11}
- B: 1×10^{-12}
- C: 4×10^{-14}
- D: 5×10^{-12}

13. **1 mol/L of A_2 is present as a reactant. At equilibrium 11% of it gets dissociated into B and C according to the given equation**

$A_2 \rightleftharpoons B + C$

K_c for the reaction is?

- A: 1.2
- B: 1.36
- C: 1.48
- D: 2.36

14. **Equilibrium in which of the following reaction is not affected by changes in volume?**

- A: $2SO_2 + O_2 \rightleftharpoons 2SO_2$
- B: $PCl_5 \rightleftharpoons PCl_3 + Cl_2$
- C: $N_2 + 3H_2 \rightleftharpoons 2NH_3$
- D: $2HF \rightleftharpoons H_2 + F_2$

15. **Two moles of PCl_5 were heated to 400^0C in a 2-litres closed vessel. At equilibrium, 40% of PCl_5 was dissociated into PCl_3 & Cl_2. Its K_C will be?**

- A: 0.267 mol/liter
- B: 0.548 mol/liter
- C: 2.342 mol/liter
- D: None of the above.

16. **If difference in pK_a of two acids is 2 then?**

- A: One acid is two times stronger than the other.
- B: One acid is ten times stronger than the other.
- C: One acid is twenty times stronger than the other.
- D: One acid is hundred times stronger than the other.

17. **The aqueous solution of which of the following would produce an Acidic buffer solution?**

- A: $NH_4Cl + NH_4OH$
- B: $CH_3COONa + CH_3COOH$
- C: NaCl + NaOH
- D: $Na_2SO_4 + H_4SO_4$

18. **The solubility product of As_2O_3 is S. What is the value of K_{sp} if As_2O_3 dissolves as $2As^{3+} + 3\ O^{2-}$?**

- A: $6s^3$
- B: $48s^4$
- C: $108s^5$
- D: $27s^7$

TEST 4

1. If $A_x B_y \rightleftharpoons xA^{+y} + yB^{-x}$ then the value of value of K_{sp} is?

- A: $K_{sp} = [A^{+y}]^x [B^{-x}]^y$
- B: $K_{sp} = x[A^{+y}]\ y[B^{-x}]$
- C: $K_{sp} = [A^{+y}]^y [B^{-x}]^x$
- D: $K_{sp} = [A^{+y}]^y + [B^{-x}]^x$

2. A + B ⇌ C + D. If some of the C is removed at equilibrium the reaction would?

- A: Remain at equilibrium
- B: Proceed in forward direction
- C: Proceed in reverse direction
- D: Reaction would continue to never reach an equilibrium

3. Formation of ammonia is a reversible and exothermic process, what will happen on cooling?

- A: More N_2 will be formed
- B: More H_2 will be formed
- C: More products (ammonia) will form
- D: More reactant will form

4. $2HI \text{ ---> } H_2 + I_2$ is a reversible reaction. It is not affected by which of the following?

- A: Temperature
- B: Catalyst
- C: Volume
- D: Pressure

5. If at any particular time, the ratio fo products and reactancts is less than K_c then which of the following is true?

- A: The reaction is at equilibrium
- B: Forward reaction would occur
- C: Reverse reaction would occur
- D: None of the above.

6. The favorable conditions for Haber's process are?

- A: High temperature and high pressure
- B: Low temperature and low pressure
- C: High temperature and low pressure
- D: Low temperature and high pressure

7. For a reaction equilibrium, N_2O_4 (g) ⇌ $2NO_2$ (g), the concentrations of N_2O_4 and NO_2 at equilibrium are 4.8×10^{-2} and 1.2×10^{-2} mol/L respectively. The value of K_c for the reaction is?

- A: 0.25×10^{-2} mol/L
- B: 0.3×10^{-3} mol/L
- C: 3×10^{-3} mol/L
- D: 4.8×10^{-2} mol/L

8. If K_a for an acid is higher, the stronger is the acid, relate the strength of acid with pK_a:

- A: Higher pK_a ,weaker the acid
- B: Lower pK_a ,stronger the acid
- C: pK_a has no relation with the strength of an acid
- D: Both a and b

9. A buffer solution is that which resists / minimizes the change in:

- A: Ph
- B: pOH
- C: PK_a
- D: PK_b

10. In the Haber's process, volume of ammonia at equilibrium is?

- A: 25%
- B: 35%
- C: 45%
- D: 55%

11. Units of K_c for this reaction is?

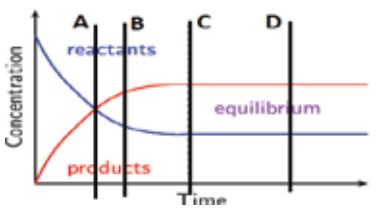
$H_2 + I_2$ -----> 2HI

- A: mol^2dm^{-6}
- B: $mol\ dm^{-3}$
- C: No unit
- D: $mol^{-2}dm^6$

12. 0.5 molar solution of NaOH contains?

- A: 40g of NaOH in 1 lit of solution
- B: 20g of NaOH in 1 lit of solution
- C: 80g of NaOH in 1 lit of solution
- D: 10g of NaOH in 1 lit of solvent

13. In the graph below, the equilibrium time is given by which line?



- A: A
- B: B
- C: C
- D: D

14. For the reaction $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$, the equilibrium constants expressed in terms of concentration K_c and in terms of partial pressures K_p, are related as?

- A: $K_p = K_c(RT)^2$
- B: $K_c = K_p(RT)^2$
- C: $K_p = K_c$
- D: $K_p = K_c(RT)^3$

Solutions

TEST 1

1. Which of the following statements is not true about the ideal solutions?

- A: There is no enthalpy change on mixing.
- B: There is no volume change on mixing.
- C: The interactions between the components are similar to those in the pure components.
- D: The components show positive and negative deviations from Raoult' s law.

2. Which of the following is/are important day to day application of colligative properties of solutions?

- A: Creation of CFCs.
- B: Creation of antifreeze.
- C: Creation of transmission fluids.
- D: All of the above.

3. Elevation of the boiling point of a solution can be measured by which of the following method?

- A: Colligative method.
- B: Landsberger's method.
- C: Beckmann's apparatus.
- D: Raoult's method.

4. Which of the following is true for a solution?

- A: Solute = Solvent
- B: Solute < Solvent
- C: Solute > Solvent
- D: Solute may or may not be less than the solvent

5. The amount of energy release by absorbing an electron in valence shell is:

- A: Atomization
- B: Electron energy
- C: Electro negativity
- D: Ionization energy

6. The process in which the water molecules surround the solute ions or molecules is called?

- A: Hydrolysis
- B: Hydrogenation
- C: Halogenations
- D: Hydration

7. Which of the following is an example of immiscible solution?

- A: NaCl-Water
- B: Phenol-Water
- C: Nicotine-Water.
- D: Water-Benzene

8. Which of the following conditions should be fulfilled by a solution in order to observe the colligative properties?

i. Solution should be dilute ii. Solution should be non-volatile,

iii. Solution should be non-electrolyte

- A: i and ii only
- B: i and iii only
- C: ii and iii only
- D: i, ii and iii.

9. Which of the following defines the colligative properties of the solutions?

- A: Properties that remains constant over a range of temperature.
- B: Properties that remains constant over a range of pressure.
- C: Properties that depend on the chemical species present.
- D: Properties that depend on the number of solute and solvent molecules.

10. The number of moles of solute in 1000 g of the solvent is called?

- A: Morality
- B: Mole fraction
- C: Parts per million
- D: Molality

11. Which of the following is the most accurate definition of a solution?

- A: A mixture of two or more kinds of different substances.
- B: A heterogeneous mixture of two or more kinds of different substances.
- C: A homogeneous mixture of two or more kinds of different substances.
- D: A homogeneous mixture of two or more kinds of same substances.

12. Which of the following factors account for the solutions' deviations from Raoult's Law?

- A: Size of the molecules,
- B: Shape of the molecules.
- C: Intermolecular forces.
- D: All of the above.

13. Which of the following is the correct definition of molarity?

- A: Number of moles of solute in 1000 g of the solvent.
- B: Number of moles of solute in 100 g of the solvent.
- C: Number of moles of solute in 1 liter of the solution.
- D: Number of moles of solute in 1 mL of the solution.

14. Which of the following is the mathematical representation of Raoult's law?

- A: $p = p^o x$
- B: $p = p^o / x$
- C: $p = p^o + x$
- D: $p = p^o - x$

15. The temperature at which two conjugate solutions merge into one another is called?

- A: Upper consulate temperature
- B: Mixing temperature
- C: Conjugate temperature
- D: None of the above.

16. Which of the following is the most important application of the colligative properties?

- A: Molecular mass determination.
- B: Identification of chemical properties.
- C: Determination of boiling points.
- D: Determination of vapour pressure.

17. A chemical reaction during which molecules of water (H_2O) are split into hydrogen cations (H^+) and hydroxide anions (OH^-) is called?

- A: Hydration
- B: Neutralization
- C: Hydrogenation
- D: Hydrolysis

18. Which of the following is true for completely miscible liquids solutions?

- A: Their volume decrease on mixing.
- B: Their volume increase on mixing.
- C: Their volume remain same on mixing.
- D: Their volume may increase or decrease on mixing.

19. Which of the following form conjugate solutions?

- A: Completely miscible liquids
- B: Partially miscible liquids
- C: Immiscible liquids
- D: Both B and C.

20. A sample of matter with uniform properties and fixed composition is called a?

- A: Solution
- B: Phase
- C: Substrate
- D: Solvent

TEST 2

1. **Which of the following is a definition of Rault's law**?

- A: Increase of vapour pressure is directly proportional to the mole fraction of solute.
- B: Increase of vapour pressure is directly proportional to the mole fraction of solvent.
- C: Lowering of vapour pressure is directly proportional to the mole fraction of solute.
- D: Lowering of vapour pressure is directly proportional to the mole fraction of solvent.

2. Mole fraction of any component is the ratio of moles of all components in a:

- A: Compound
- B: Solution
- C: Molecule
- D: Solid

3. Percentage volume/weight concentration is equal to?

- A: The number of cm^3 of a solute dissolved per 1 g of the solution.
- B: The number of cm^3 of a solute dissolved per 10g of the solution.
- C: The number of cm^3 of a solute dissolved per 100g of the solution.
- D: The number of cm^3 of a solute dissolved per 1000g of the solution.

4. 10 grams of glucose are dissolved in water to make 100cm^3 of its solution, its molarity is

- A: 0.55
- B: 0.1
- C: 10
- D: 1

5. Concentration in terms of percentage weight/weight is given by?

- A: Weight of the solute dissolved per one kg of the solution.
- B: Weight of the solute dissolved per 100 g of the solution.
- C: Weight of the solute dissolved per 1000 parts by weight of the solution.
- D: Weight of the solute dissolved per 100 parts by weight of the solution.

6. Which of the following unit of concentration can be used for any state of the matter for the solvent or the solute?

- A: Molality
- B: Molarity
- C: % m/v
- D: Mole fraction

7. Ionic compound dissolve in water in two steps.

i. First step: Separation of ions from solid,

ii. Second step: Solvent molecules surrounding the ions

Which of the following statement is true about this process?

- A: The first step is exothermic and the second is isothermic.
- B: The first step is endothermic and the second is isothermic.
- C: The first step is exothermic and the second is endothermic.
- D: The first step is endothermic and the second is exothermic.

8. Which of the following statements is correct?

- A: Only liquids can act as a solvent in a solution.
- B: Only gases and liquids can act as a solvent in a solution.
- C: Only gases can act as a solvent in a solution.
- D: Solids, liquids and gases all can act as a solvent in a solution.

9. Which of the following salts are easily hydrolysed in water?

i. Salts of stong acids, ii. Salts of weak acids, iii. Salts of weak bases

- A: i only
- B: i and ii only
- C: ii and iii only
- D: i, ii and iii.

10. Suppose, a sample of 100 g of water solution contains 0.025 g of chlorine. The concentration of chlorine in ppm will be?

- A: 25 ppm
- B: 150 ppm
- C: 180 ppm
- D: 250 ppm

11. A student mixed ethyl alcohol with small amount of sodium dichromate and added it to the hot solution of dilute sulphuric acid. A vigorous reaction took place. He distilled the product formed immediately. What was the product?

- A: Acetone
- B: Acetic acid
- C: Dimethyl ether
- D: Acetaldehyde

12. Salts which are not hydrolysed by water give?

- A: Acidic solution.
- B: Basic solution.
- C: Neutral solution.
- D: May give both acidic or basic solution.

13. Lowering of the vapour pressure of binary solutions is given by the formula? (W_1 and W_2 are the masses of the solvent and the solute and M_1 and M_2 are the molecular masses respectively)

- A: $M_2 = \frac{p^o}{\Delta p}\frac{W_2 M_2}{W_1}$
- B: $M_2 = \frac{p^o}{\Delta p}\frac{W_2 M_1}{W_1}$
- C: $M_2 = \frac{\Delta p}{p^o}\frac{W_2 M_1}{W_1}$
- D: $M_2 = \frac{\Delta p}{p^o}\frac{W_2 M_2}{W_1}$

14. 0.100 mole of NaCl is dissolved into 100.0 grams of pure H_2O. What is the mole fraction of NaCl?

- A: 0.018
- B: 0.260
- C: 0.564
- D: 0.982

15. Which type of ions are most easily hydrated?

- A: High charge density ions.
- B: Moderate charge density ions.
- C: Low charge density ions.
- D: Neutral molecules.

16. 50 ml of ethanol dissoved in 200 ml of solution gives v/v % of solution = ?

- A: 4 %
- B: 25 %
- C: 50 %
- D: 60 %

17. Which of the following units of concentration are not affected by temperature?
i. % w/w, ii. Molarity, iii. Molality

- A: i only
- B: i and ii only
- C: i and iii only
- D: i, ii and iii only.

18. Which of the following unit of concentration would you recommend to calculate impurities in pure water?

- A: Molarity
- B: % w/v
- C: Parts per million
- D: Molality

19. The vapour pressure of a dilute solution of a solute is not influenced by?

- A: Temperature of the solution.
- B: Mole fraction of the solute.
- C: Degree of dissociation of the solute.
- D: Melting point of the solute.

20. Sea water has 5.65 x 10^{-3} g of dissolved oxygen in one kilogram of water. The concentration of oxygen in ppm is:

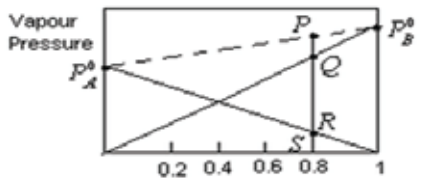
- A: 7.69
- B: 5.65
- C: 5.20
- D: 4.11

TEST 3

1. Solubility for which of the following salt decrease with the increase in temperature?

- A: $Pb(NO_3)_2$
- B: $CaCl_2$
- C: KCl
- D: $Ce_2(SO_4)_3$

2. Consider the following vapour pressure - mole fraction graph. SP (Total vapour pressure of the resultant solution) is equal to



- A: PQ + RS
- B: PQ + QR + RS
- C: SR + SQ
- D: PQ + QR

3. Which of the following statement is true regarding the molal and molar solution of the same numerical value?

- A: Molal aqueous solution of a solute has same concentration as of molar solution.
- B: Molal aqueous solution of a solute is dilute as compared to the molar solution.
- C: Molar aqueous solution of a solute is dilute as compared to the molal solution.
- D: None of the above.

4. 500 mL of 0.75 w/v % NaCl solution would contain how many grams of NaCl?

- A: 0.75 g
- B: 1.5 g
- C: 3.75 g
- D: 4.8 g

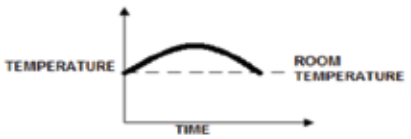
5. If 0.5 g of a solute (molar mass 100 g mol-1) in 25 g of solvent elevates the boiling point by 1 K. The molar boiling point constant of the solvent is?

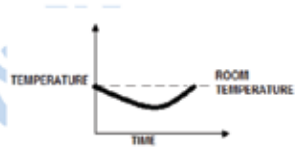
- A: 0.2
- B: 2
- C: 5
- D: 8

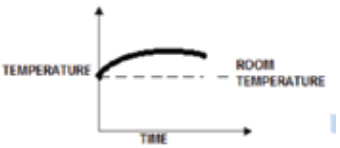
6. **Given soultion contains 16g of CH_3OH , 92g of C_2H_5OH and 36g water. Which statement about mole fraction of component is true?**

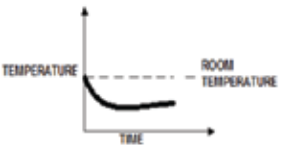
- A: Mole fraction of CH_3OH highest among all
- B: Mole fraction of C_2H_5OH and water is same
- C: Mole fraction of CH_3OH and C_2H_5OH is same
- D: Mole fraction of water is lowest

7. **Dissolution of ammonium nitrate in water is an endothermic process. Which of the following graphs shows how the temperature alerts as the ammonium nitrate is added to water and then the solution is left at room temperature?**

A: 

B: 

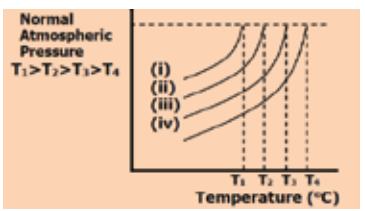
C: 

D: 

8. **g of a non-electrolyte solute (molar mass 250 g mol-1) was dissolved in 51.2 g of benzene. If the freezing point depression constant, Kf of benzene is 5.12 K kg mol-1, the freezing point of benzene will be lowered by?**

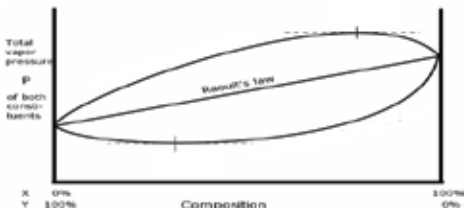
- A: 0.5 K
- B: 0.4 K
- C: 0.2 K
- D: 0.1 K

9. **The vapour pressure lines for pure as well as solutions of different concentrations are shown below. Which line represents pure water?**



- A: I
- B: II
- C: III
- D: IV

10. The composition-temperature curve given below is for what type of mixtures?



- A: Zeotropic mixtures.
- B: Azeotropic mixtures.
- C: Partially miscible mixtures.
- D: Fully miscible mixtures.

11. What is the mole fraction of cinnamic acid in a mixture that is 50.0% weight urea in cinnamic acid (urea = 60 g/mol; cinnamic acid = 148 g/mol)

- A: 0.62
- B: 0.56
- C: 0.48
- D: 0.28

12. The total vapour pressure of a mixture of 2 mole of A (Pa^o =140 mm) and 1 mole of B (Pb^o = 220 mm) is 180 mm. The solution?

- A: is an ideal solution.
- B: exhibits positive deviation from Raoult's law.
- C: exhibits negative deviation from Raoult's law.
- D: cannot be identified as data is insufficient.

13. A non-ideal solution was prepared by mixing 10 ml HCl and 90 ml of water. The volume of mixture will be?

- A: > 100 ml
- B: < 100 ml
- C: = 100 ml
- D: Could be higher or lower than 100 ml

14. The molality of an aqueous solution of sugar ($C_{12}H_{22}O_{11}$) is 1.62m. Calculate the mole fraction of sugar?

- A: 0.0911
- B: 0.0864
- C: 0.0462
- D: 0.0284

15. Approximately how many moles of water must be used to dissolve 100.0 grams of sucrose ($C_{12}H_{22}O_{11}$) to prepare a 0.020 mole fraction of sucrose in the solution? (Weight of sucrose is 342 g/mol.)

- A: 14 mol of H_2O
- B: 16 mol of H_2O
- C: 18 mol of H_2O
- D: 20 mol of H_2O

16. What is the molarity of a solution prepared by dissolving 15.0 g of sodium hydroxide in enough water to make a total of 225 mL of solution?

- A: 0.78 M/L
- B: 1.67 M/L
- C: 37.5 M/L
- D: 66.6 M/L

17. A solution is prepared by mixing 25.0 g of water, H_2O, and 25.0 g of ethanol, C_2H_5OH. Determine the mole fractions of ethanol?

- A: 0.18
- B: 0.29
- C: 0.71
- D: 0.88

18. If 1.2 g of NaCl is dissolved in water to make 160 mL of (saline) solution, what is the w/v % of NaCl?

- A: 0.75 %
- B: 1.20 %
- C: 1.50 %
- D: 1.92 %

19. If we have 450 g of an NaCl solution that is 35 NaCl w/w %. What is the mass of NaCl ?

- A: 128.5 g
- B: 157.5 g
- C: 184.5 g
- D: 200 g

20. If x ml of solute is added to y ml of solvent. The total volume of the solution is?

- A: x + y
- B: x - y
- C: x * y
- D: None of the above.

TEST 4

1. Antifreeze is made by a solution of water with?

- A: Ethanol
- B: Isobutyl Chloride
- C: Acetone
- D: Ethylene glycol

2. Which of the following solvents would not be able to dissolve NaCl?

- A: Water
- B: Acetone
- C: Ethanol
- D: Methanol

3. A 4 g sugar cube (Sucrose: $C_{12}H_{22}O_{11}$) is dissolved in 0.5 kg of water. What is the molality of the sugar solution?

- A: 0.023 mol/kg
- B: 0.117 mol/kg
- C: 0.21 mol/kg
- D: 1.2 mol/kg

4. On adding solute to a solvent having vapor pressure 0.80 atm, vapor pressure reduces to 0.60 atm. Mole fraction of the solute is?

- A: 0.25
- B: 0.48
- C: 0.75
- D: 0.90

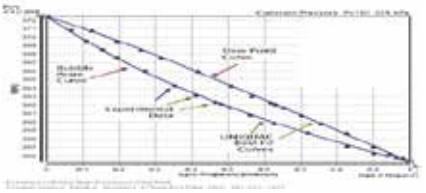
5. Azeotropic mixtures can not be regarded as chemical compounds because?

- A: They are completely separated through fractional distillation.
- B: They can not be separated through fractional distillation.
- C: Their composition remain constant on changing pressure and temperature.
- D: Their composition varies on changing pressure and temperature.

6. 5 g sugar is dissolved in 20 g of water. What is the w/w % concentration of sugar in this solution?

- A: 5 w/w %
- B: 15 w/w %
- C: 20 w/w %
- D: 25 w/w %

7. The composition-temperature curve given below is for what type of mixtures?



- A: Zeotropic mixtures.
- B: Azeotropic mixtures.
- C: Partially miscible mixtures.
- D: Fully miscible mixtures.

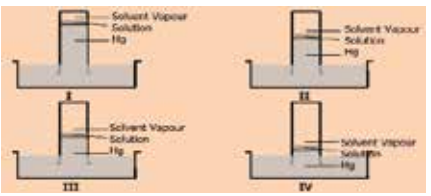
8. The crystalline substances that contain chemically combined water in definite proportions are called?

- A: Hydrides
- B: Watered Crystals
- C: Hydrites
- D: Hydrates

9. 2.0 g of benzoic acid dissolved in 25.0 g of benzene shows a depression in freezing point equal to 1.62 K. Molal depression constant kf of benzene is 4.9 K kg mol-1. What is the molar mass of the acid?

- A: 196
- B: 212
- C: 242
- D: 284

10. One mole of glucose was dissolved in one kg of water, ethanol, ether, benzene separately and molal boiling point constant of each solution was found to be 0.52 ,1.75, 2.16 and 2.70 in the units of / $^{o}Ckgmol^{-1}$. Which of the following figure shows solvent in solution



- A: I
- B: II
- C: III
- D: IV

11. The rise in the boiling point of a solution containing 1.8 g of glucose in 100 g of solvent is 0.1°C. The molal elevation constant of the liquid is? (Molar mass of glucose is 180)

- A: 0.01
- B: 0.1
- C: 1
- D: 10

12. Boiling point constants help us to determine:

- A: Volumes
- B: Pressures
- C: Masses
- D: Molar masses

13. Which one of the following is the correct representation of k_{sp} ?

- A: $K_{sp} = [AgCl] / [Ag^{+1}][Cl^{-1}]$
- B: $K_{sp} = [Ag^{+1}][Cl^{-1}] / [AgCl]$
- C: $K_{sp} = [Ag^{+1}][Cl^{-1}]$
- D: $K_{sp} = [AgCl]$

14. Miscible liquid mixtures that can be separated by fractional distillation are called?

- A: Partially miscible solutions.
- B: Completely miscible solutions.
- C: Zeotropic mixtures.
- D: Azeotropic mixtures.

15. Freezing point depression of a solution is measured by which of the following methods?

- A: Beckmann's apparatus.
- B: Landsberger's method.
- C: Raoult's method.
- D: Colligative method.

16. Which of the following solutions will show positive deviation from the ideal behavior of solutions?

- A: Chloroform and diethyl ether
- B: Ethanol and water
- C: Acetone and aniline
- D: Water and nitric acid

17. Which of the following statements is true? (consider equal sized ions)

- A: Neutral molecules are more easily hydrated.
- B: Positive ions are more easily hydrated.
- C: Negative ions are more easily hydrated.
- D: Hydration is independent of the charge density of the ions.

18. Elevation of the boiling point of a solution is?

- A: Directly proportional to the molarity of the solution.
- B: Inversely proportional to the molarity of the solution.
- C: Directly proportional to the molality of the solution.
- D: Inversely proportional to the molality of the solution.

19. As number of solute particles increases, freezing point of the solution:

- A: Remains same
- B: Increases
- C: Decreases
- D: First increase then decrease

20. Which of the following units of concentration does not change with temperature?

- A: % w/v
- B: % v/v
- C: Molarity
- D: Molality

Electrochemistry

TEST 1

1. The electrode potential of standard hydrogen electrode is arbitrarily taken as:

- A: A positive value
- B: A negative value
- C: Zero
- D: Depends upon the situation

2. Which of the following is the electrophone used to attack electrons of benzene ring?

- A: $FeCl_2$
- B: $FeCl_4$
- C: Cl^+
- D: Cl_2

3. In order to have standard hydrogen electrode, the conditions are:

- A: Temperature 25° C, pressure 1 atm, and H^+ concenteration 1M
- B: Temperature 0° C, pressure 1 atm, and H^+ concenteration 1M
- C: Temperature 25° C, pressure 2 atm, and H^+ concenteration 1M
- D: Temperature 25° C, pressure 1 atm, and H^+ concenteration 2M

4. In calculators and digital watches which battery is mostly used?

- A: Alkaline battery
- B: Silver oxide battery
- C: Ni-Cd battery
- D: Pb-storage battery

5. In oxidation process the oxidation number of the element:

- A: Increases
- B: Decreases
- C: Does not change
- D: May increase or decrease.

6. The value of SHE as cathode and anode is always taken to be:

- A: One
- B: Zero
- C: Different
- D: Same

7. **Reduction always takes place at:**

- A: Cathode
- B: Anode
- C: Both electrodes
- D: None of the above

8. **The oxidation potential of Mg and Al are +2.37v and 1.66V respectively. The Mg in chemical reaction:**

- A: Will be displaced by Al
- B: Will displace Al
- C: Won't be able to replace Al
- D: None of the above

9. **In electrochemical series , the electrodes are compared with SHE and they are arranged in the decreasing order of their:**

- A: Cell voltages
- B: Ionization potentials
- C: Reduction potentials
- D: Oxidation potentials

10. **In electrolysis reduction takes place at:**

- A: Anode
- B: Cathode
- C: Both anode and cathode
- D: Depends upon the nature of electrode material

11. **Electrolysis is the process in which a chemical reaction takes place at the expense of:**

- A: Chemical energy
- B: Kinetic energy
- C: Heat energy
- D: Electrical energy

12. **When one metal is deposited on the surface of the other by the process of electrical current, the process is called?**

- A: Electrolytic refining
- B: Electrolytic purification
- C: Electrolysis
- D: Electroplating

13. **The process in which electric current is used to carry out a non-spontaneous redox reaction is called:**

- A: Electrolyte
- B: Electrolysis
- C: Metallic conduction
- D: Combustion

14. A redox reaction is:

- A: A reaction in a solution
- B: Ion combination reaction
- C: Electron transfer
- D: Proton transfer

15. An electrochemical cell is based upon:

- A: Acid-Base reaction
- B: Redox reaction
- C: Nuclear reaction
- D: Catalytic reaction

16. A process of covering one metal with a thin layer of another metal is called:

- A: Electrolysis
- B: Electroplating
- C: Electrode potential
- D: Standard electrode

17. The process in which ionic compound when fused or dissolved in water split up into charged particles is called:

- A: Electrolysis
- B: Hydration
- C: Ionization
- D: Conduction

18. The oxidation number of free element is always taken to be:

- A: 0
- B: 1
- C: 2
- D: -1

19. What is the algebraic sum of oxidation numbers of all the elements in the neutral molecules?

- A: -1
- B: 1
- C: 0
- D: -2

20. One of the following definitions of oxidation is correct. Indicate that:

- A: Addition of oxygen, addition of hydrogen, removal of electron
- B: Removal of electronegative element, removal of electropositive element, gain of electron
- C: Addition of electronegative element, removal of electropositive element, gain of electron
- D: Addition of oxygen, removal of hydrogen, loss of electron

TEST 2

1. Electric current passes through both molten and solution form of NaCl because of?

- A: Ionic bonding
- B: Na^+ and Cl^- ions
- C: Ions of water
- D: Hydration of ions

2. Graphite is an inert electrode. When the electrolysis of aqueous solution of NaCl is carried out by using graphite electrode, then the substance collected at the cathode is:

- A: Hydrogen gas
- B: Sodium metal
- C: Sodium hydroxide
- D: Chlorine gas

3. Zinc-copper galvanic cell may be formed by:

- A: Salt brigde
- B: Porous partitions
- C: Both a and b
- D: None of the above

4. The best reducing agent in the given list is?

- A: F^{-1}
- B: Cl^{-1}
- C: Br^{-1}
- D: I^{-1}

5. Electrochemical series is useful in:

- A: Prediction of the feasibility of a chemical reaction
- B: Comparison of the metals to get oxidized or reduced
- C: Calculation of voltage
- D: All of the above

6. Oxidation number of oxygen +2 in which of the following?

- A: Na_2O
- B: Na_2O_3
- C: F_2O
- D: Cl_2O

7. Which one of the following is a redox reaction?

- A: $NaCl + AgNO_3$ -----> $NaNO_3 + AgCl_2$
- B: $2Na+Cl_2$ ------> $2NaCl$
- C: 2Cl -------> $Cl_2+ 2e^-$
- D: $Na^+ +1e^-$ ----------> Na

8. The reaction in galvanic cell is :

- A: Spontaneous
- B: Non-sapontaneous
- C: Acid-Base
- D: None of these

9. During electrolysis of KNO_3, H_2 is evolved at:

- A: Anode.
- B: Cathode.
- C: Both A and B.
- D: Neither cathode nor anode.

10. In electrolytic cell a salt bridge is used in order to:

- A: Pass electric current
- B: Prevent flow of ions
- C: Mix solutions of two half cells
- D: Allow movement of ions between two cells

11. Standard hydrogen electrode has an arbitrary fixed potential of :

- A: 0 V
- B: 1.0 V
- C: 0.1 V
- D: 0.001 V

12. Study the following facts and choose.

Zn -------> Zn^{2+} +2e^- E^o = +0.76V, Cu --------> Cu^{2+} +2e^- E^o = -0.34V

- A: $Cu + Zn^{+2}$ ---------> $Cu^{2+} + Zn$
- B: $Cu^{2+} + Zn^{+2}$ ---------> $Cu + Zn$
- C: $Cu^{2+} + Zn$ ---------> $Cu + Zn^{2+}$
- D: $Cu^{2+} + Zn^{+2}$ ---------> $Cu + Zn^{2+}$

13. In a galvanic cell, the electrode occupying a lower position in the electrochemical series will act as:

- A: Cathode
- B: Oxidation will take place on it
- C: Reduction will take place on it
- D: Both A and C

14. Which of the following is a secondary cell?

- A: Alkaline battery
- B: Dry cell
- C: H_2-O_2 cell
- D: Mercury cell

15. When fused $PbBr_2$ is electrolyzed then which of the following occurs?

- A: Bromine appears at cathode.
- B: Lead is deposited at cathode.
- C: Lead is deposited at anode.
- D: Both A and C

16. During electrolysis of $H_2SO_{4(aq)}$ O_2 is evolved at?

- A: Cathode
- B: Anode
- C: Both a and b
- D: None of the above

17. If a salt bridge is not used between two half cells, then voltage :

- A: Decreases rapidly.
- B: Decrease slowly.
- C: Does not change.
- D: Drops to zero.

18. The reduction potential of Al is -1.66V and that of Sn is -0.14V. When these two electrodes are connected through a salt bridge, then which of the following electrode act as cathode:

- A: Al electrode
- B: Sn electrode
- C: Depends upon the temperature of cell
- D: Depends upon the concenteration of solution in the salt bridge.

19. Which one is the correct equation of 1st ionization of sulphuric acid?

- A: $H_2SO_4 + H_2O$ ----------> $2H^+ + SO_4^{3-}$
- B: $H_2SO_4 + H_2O$ ----------> $H_3O^+ + HSO_4^-$
- C: $H_2SO_4 + H_2O$ <---- ---> $2H^+ + SO_4^{2-}$
- D: $H_2SO_4 + H_2O$ ----------> $H_2O^+ + SO_4^{2-}$

20. A cell in which sapontaneous redox reaction generates an electric current is called?

- A: Electrolytic cell
- B: Electrochemical cell
- C: Voltaic and galvanic cell
- D: Biological cell

TEST 3

1. The electrode reaction of a voltaic cell can be reversed when:

- A: Concenterations of solution are changed
- B: Temperature is increased
- C: Electrodes are interchanged
- D: External circuit is employed to supply the source of electricity

2. Sulphur has highest oxidation state in:

- A: SO_2
- B: SO_3
- C: H_2S
- D: H_2SO_3

3. When Pb accumulator is recharged , then the density of H_2SO_4becomes:

- A: 2.15 gcm^{-3}
- B: 1.81 gcm^{-3}
- C: 1.25gcm^{-3}
- D: 1.15 gcm^{-3}

4. If the sum of E^o values of the two half cells is positive, then

- A: The reaction will not be feasible
- B: The reaction may or may not be feasible
- C: The reaction will be feasible
- D: No prediction can be made.

5. The reaction given below is an example of:

$2KI + Cl_2 \longrightarrow I_2 + 2KCl$

- A: Chlorination of potassium
- B: Neither oxidation nor reduction
- C: Neutralization reaction
- D: Oxidation reduction reaction

6. Oxidation number of C in CH_2Cl_2:

- A: +2
- B: +4
- C: -4
- D: 0

7. Strong reducing agents have:

- A: Greater positive value of standard reduction potential
- B: Greater negative value of standard reduction potential
- C: Lesser positive value of standard reduction potential
- D: None of these

8. Strongest reducing agent in the electrochemical series is:

- A: I_2
- B: F
- C: H_2
- D: Li

9. Oxidation number of oxygen in OF_2 is?

- A: +1
- B: -1
- C: +2
- D: -2

10. Oxidation of sulphur in $S_2O_3^{2-}$ is:

- A: +6
- B: -2
- C: +2
- D: +4

11. In the reaction $3Cl_2 + 6NaOH$ -----> $5NaCl + NaClO_3 + H_2O$, chlorine is:

- A: Oxidized
- B: Reduced
- C: Both a and b
- D: None of the above

12. Which one of the following statements about SHE is correct?

- A: Its oxidation potential is zero but reduction potential is positive
- B: Its reduction potential is zero but oxidation potential is negative
- C: Its oxidation potential and reduction potential both are zero
- D: The solution in the electrode is 0.1 molar HCl

13. Oxidation number of C in $NaHCO_3$:

- A: +4
- B: -6
- C: +6
- D: +2

14. The oxidation of oxygen in peroxides is?

- A: +1
- B: -1
- C: +2
- D: -2

15. Which elemnt act as reducing agent in the reaction?

$$Zn\ (s) + H_2SO_4\ (aq) \text{------>} ZnSO_4\ (aq) + H_2\ (g)$$

- A: Zn
- B: H
- C: S
- D: O

16. Oxidizing power of an element depends upon its:

- A: Oxidation potential
- B: Ionization energy
- C: Electron affinity
- D: Electrode potential

17. Coinage metals have least reactivity because they have:

- A: Positive oxidation potential
- B: Positive reduction potential
- C: Zero oxidation potentials
- D: Zero reduction potentials

18. Which of the following is non-rechargeable battery?

- A: Lead accumulator battery
- B: Alkaline battery
- C: Ni-Cd battery
- D: Fuel cell

19. Metals which are above SHE in electrochemical series:

- A: Can liberate H_2 from dil. Acid
- B: Can not liberate H_2 from dil. acid
- C: Require heat to liberate H_2 from dil. Acid
- D: Require current to liberate H_2 from dil. acid

20. Coinage metals Cu, Ag and Au are least reactive because they have :

- A: Negative reduction potential
- B: Positive Reduction potential
- C: Negative oxidation potential
- D: Posiitive oxidation potential

TEST 4

1. In all oxidation reactions, atoms of an elements in chemical species lose electrons and increases their :

- A: Oxidation state
- B: Reduction state
- C: Electrode
- D: Negative charges

2. What is the correct rotation between pH and PK?

- A: $pH = pK_a + \log [Acid/Base]$
- B: $pH = pK_a - \log [Acid/Base]$
- C: $pH = pK_a + \log [Base/ acid]$
- D: $pK_a = pH + \log [Base/ acid]$

3. When mixture of bauxite($Al_2O_3.2H_2O$) and cryolite (Na_3AlF_6) in the fused state is electrolyzed by using carbon as anode, then the product obtained at the cathod is:

- A: Sodium metal
- B: Aluminium metal
- C: Fluorine gas
- D: The mixture of sodium and aluminium metal

4. In which of the following given changes, there is a transfer of five electrons?

- A: MnO_4^{2-}-----> MnO_2
- B: CrO_4^{2-} ---> Cr^{+3}
- C: MnO_4^{-}-----> Mn^{+2}
- D: $Cr_2O_7^{2-}$ ---> $2Cr^{+3}$

5. Electromotive force of the cell is the:

- A: Difference of two electrode potentials
- B: Sum of two electrode potential
- C: Depends upon the nature of the cell
- D: May be sum of or difference of two electrode potentials

6. During redox reaction, an oxidizing agent:

- A: Gain electrons.
- B: Is oxidized.
- C: Lose electrons.
- D: Is hydrolysed.

7. When copper sulphate is electrolysed in aqueous solution using copper electrodes, then the substance which deposits at the cathode is:

- A: Copper metal
- B: Copper ion
- C: Hydrogen
- D: Oxygen

8. During electrolysis of molten NaCl, the ion is reduced is:

- A: Cl^-
- B: Na^+
- C: Na^+ or Cl^-
- D: Na^+ and Cl^-

9. For the net reaction:

$Cr^o + Fe^{+3} \text{------>} Cr^{+3} + Fe^o$

- A: Cr is the oxidizing agent
- B: Fe is cathode
- C: Fe^{+3} is reducing agent
- D: Cr undergoes reduction

10. Stronger the oxidizing agent, greater is the:

- A: Oxidation potential
- B: Reduction potential
- C: Redox potential
- D: E.M.F. of cell

11. The metallic conductors in contact with the solution are called:

- A: Insulator
- B: Electrodes
- C: Electrolyte
- D: Down cell

12. To balance chemical equation by ion-electron method in the basic media we add:

- A: Double the number of oxygen atoms
- B: Double the number of OH^- ions
- C: Double the number of H_2O molecules
- D: Equal number of H^+ ions

13. In order to measure the standard electrode potential of an electrode, which of the following conditions are maintained:

- A: Solution of 1 molar strength and temperature of 0^o C
- B: Solution strength at 25^o C and compared with S.H.E.
- C: Solution of 1 molar strength at 298K compared to S.H.E.
- D: Solution of any strength at any temperature and the electrode is connected with S.H.E.

14. A cell in which current drives a non-sapontaneous reaction is called:

- A: Electrolytic cell
- B: Voltaic cell
- C: Biological cell
- D: Electrochemical cell

15. In $MgCl_2$, the oxidation state of Cl is?

- A: +2
- B: -2
- C: -1
- D: Zero

16. In the reaction :

$$2Fe + 3Cl_2 \longrightarrow 2FeCl_3$$

- A: Fe is reduced.
- B: Fe is oxidized.
- C: Cl_2 is oxidized.
- D: None of the above.

17. Greater the value of standard reduction potential of a species:

- A: Greater is tendency to accept electrons.
- B: Lesser is tendency to accept electrons.
- C: Greater is tendency to lose electrons.
- D: None of the above.

18. Halogens are highly electronegative and they lie below SHE in electrochemical series. For this reason F_2,Cl_2 etc:

- A: React with steam to liberate hydrogen
- B: Can undergo oxidation easily
- C: Can undergo reduction easily
- D: Do not react with the elements very happily above SHE in electrochemical series

19. The highest reduction potential in the electrochemical series is of F_2 and its value is:

- A: +1.49 V
- B: +2.78 V
- C: +2.87 V
- D: -3.87 V

20. The oxidation number of chromium in $K_2Cr_2O_7$ is?

- A: +14
- B: +12
- C: +6
- D: None of these

Reaction Kinetics

TEST 1

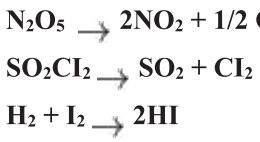
1. The rate of reaction between two specific time intervals is called?

- A: Average rate of reaction.
- B: Instantaneous rate of reaction.
- C: Total rate of reaction.
- D: Uniform rate of reaction.

2. The rate of an irreversible reaction?

- A: Increases with an increase in the concentration of the reactants
- B: Decreases with an increase in the concentration of the reactants
- C: Increases with an increase in the concentration of the products
- D: Decreases with an increase in the concentration of the products

3. Consider the following reactions



The correct statement about these reactions is ?

- A: i is a second order reaction
- B: ii and iii are first order reactions
- C: iii is a first order reaction
- D: i and ii are first order reactions

4. Which of the following best defines the activation energy?

- A: Minimum energy required to start a reaction.
- B: Minimum energy required for effective collisions.
- C: Minimum energy required to activate a catalyst.
- D: Both A and B

5. Which of the following techniques for measuring the rate of reaction measures the changes in refractive index?

- A: Spectrometry.
- B: Dilatometric method.
- C: Refractrometric method.
- D: Optical rotation method.

6. The studies concerned with the rates of chemical reactions are called?

- A: Thermochemistry
- B: Electrochemistry
- C: Physcial chemistry
- D: Reaction kinetics

7. The order of reaction with respect to a particular component, 'y' is zero. This implies that?

- A: The number of molecules forming the activated complex is zero.
- B: The rate of reaction is independent of the concentration of y.
- C: The rate of reaction is proportional to the concentration of y.
- D: The rate of reaction does not vary with temperature.

8. In zero order reactions, the rate is independent of?

- A: Temperature of the reaction.
- B: Concentration of the reactants.
- C: Presence of catalysts.
- D: Time at which the rate is determined

9. Certain substances decreasing the activity of a catalyst are called?

- A: Negative catalysis.
- B: Catalyst poisoning.
- C: Autocatalysis
- D: Catalyst deactivation.

10. Unit of rate constant of zero order reaction is?

- A: sec^{-1}
- B: mol lit^{-1} sec^{-1}
- C: litre mol^{-1} sec^{-1}
- D: $litre^{2}$ mol^{-2} sec^{-1}

11. A scientist prepared a compound in the laboratory. He found that it has two forms, one powder form and another crystalline form C. Both A and C reacts with sulfuric acid. One possible prediction is that ?

- A: A has higher rate of reaction.
- B: C has higher rate of reaction.
- C: Both A and C have same rate of reaction.
- D: No prediction can be made from the given information.

12. The units of the rate of reaction are?

- A: moles dm^3 s^{-1}
- B: moles dm^{-3} s^{-2}
- C: moles dm^{-3} s
- D: moles dm^{-3} s^{-1}

13. Which of the following is the correct expression for the rate of reaction?

- A: Change in the concentration of the substance / Time taken for the change
- B: Change in the concentration of the substance * Time taken for the change
- C: Change in the concentration of the substance
- D: Change in the concentration of the substance / log (Time taken for the change)

14. The reaction rate in forward direction decreases with the passage of time because:

- A: Concentration of products decreases.
- B: Concentration of reactants decreases.
- C: The order of reaction changes.
- D: Temperature of system changes.

15. Two step reaction is given below,

Step 1: A + A ---> C + D (slow step), Step 2: C + B ----> E + F (fast step)

Which of the following is the rate determining step?

- A: Step 1
- B: Step 2
- C: Both Step 1 and Step 2
- D: Neither Step 1 nor Step 2

16. When the change in concentration is 6×10^{-4} $moldm^{-3}$ and time for that change is 10 seconds, the rate of reaction will be :

- A: 6×10^{-2} $moldm^{-3}sec^{-1}$
- B: 6×10^{-3} $moldm^{-3}sec^{-1}$
- C: 6×10^{-4} $moldm^{-3}sec^{-1}$
- D: 6×10^{-5} $moldm^{-3}sec^{-1}$